Appendix D. Greenhouse Gas Inventory

Introduction

The City of Renton hired Cascadia Consulting Group to conduct the City's first greenhouse gas inventory. The purpose of the inventory is to help Renton better understand its current impacts and provide a baseline from which to reduce greenhouse gas (GHG) emissions, energy use, and costs. Inventories help cities identify and quantify their current emissions and activities, set appropriate and meaningful reduction targets and strategies, and measure progress toward meeting emission reduction goals.

This first inventory provides a valuable framework that Renton can use to conduct future inventories, benchmark progress, realize energy cost savings, and reduce its environmental impacts. Cascadia worked closely with City staff at Renton to develop this inventory of GHG emissions from both the City's municipal operations and the Renton community as a whole.

We used ICLEI's Clean Air and Climate Protection software to conduct the inventory. Based on input and available data from the City of Renton, the inventory establishes 2009 as the baseline year for conducting measurements, setting targets, and monitoring future progress.

As detailed in the greenhouse gas inventory that follows, the City of Renton's municipal operations generated slightly more than 14,000 metric tons of carbon dioxide equivalents (mtCO2e) in the base year 2009. At the municipal level, building energy use generated the most emissions, accounting for 40% of the total municipal emissions. Emissions sources included electricity consumption; natural gas, gasoline, and diesel combustion; and refrigerant gases.

The municipal inventory covered the following sectors:

1. **Building energy use.**
2. **Fleet fuel consumption.**
3. **Water and wastewater pump stations (electricity use).**
4. **Refrigerants.**
5. **Traffic and street lights.**
6. **Business travel.**
7. **Employee commuting.**

In 2009, the Renton community generated approximately 1.2 million mtCO_2e. The **community inventory** included the following sectors:

- **Transportation (vehicle and air miles traveled).**
- **Solid waste.**
- **Residential, commercial, and industrial energy use.**

For the community inventory, transportation was the largest contributor, accounting for almost 50% of emissions. As Renton moves forward by setting emissions reduction goals, both nearby municipalities and existing frameworks can offer guidance. Adopted in 1997, the Kyoto Protocol is the prevailing framework for emissions reductions that many nations and a number of cities in the U.S. and around the world have adopted. More than 1,000 cities, including Renton, have signed

on to the U.S. Mayors' Climate Protection Agreement, striving to meet the Kyoto targets in their own communities. The Kyoto Protocol stipulates a 7% reduction of emissions below 1990 levels by 2012. Washington State has adopted longer-term goals, including returning to 1990 levels by 2020. A number of local governments in the region have adopted targets using more recent base years, such as King County (2007 base year), Anacortes (2000), Bellingham (2000), Kirkland (2005), and Spokane (2005). In consideration of the detailed data available for Renton for 2009, Cascadia recommended and the City decided to use 2009 as Renton's baseline year.

Analysis of Renton's municipal and community inventories revealed opportunities for Renton to achieve its energy use and emissions reduction targets through straightforward actions. The most direct way for Renton to reduce its carbon footprint is by taking actions to lower emissions within its own municipal operations. Opportunities to reduce emissions from Renton's highest-emitting sectors—transportation, water delivery, and vehicle fleet—include implementing energy efficiency management and performance monitoring systems for all City buildings, targeting cost-effective efficiency upgrades in the City's most energy-intensive buildings, encouraging low impact development techniques to reduce wastewater, and creating policies for employees to use the most fuel- efficient vehicles whenever possible.

Though emissions outside the City's direct control may be more difficult to address, Renton could seek to reduce community emissions through such efforts as expanding educational campaigns about utility rebates and energy conservation measures, improving access to public transportation, and supporting the development of electric vehicle infrastructure in Renton.

The following sections describe the methodology Cascadia used to develop the inventory, presents a detailed overview of municipal and community greenhouse gas emissions by sector, identifies opportunities and targets informed by the inventory, and suggests actions the City can take to facilitate future measurement.

Methodology

We divided the inventory into two broad categories of emissions sources: 1) municipal emissions and 2) community emissions. Distinguishing these categories allows the City to understand and target emissions within both the direct and indirect scopes of its control. We took the following steps to conduct the inventory:

1. ***Define the Scope***
2. ***Collect the Data***
3. ***Calculate Emissions***

The following sections describe these steps in detail.

1. DEFINE THE SCOPE

The first step in conducting a city greenhouse gas inventory is to define the *scope*, or determine which activities to include. The *scope* of the inventory has a large influence on the calculated GHG emissions, and changing the scope of future inventories makes it difficult to track progress over time. Using a standard methodology for defining inventory boundaries enables comparison of inventory results with other entities conducting similar inventories.

Accordingly, Cascadia, in consultation with Renton staff, applied the widely used *Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard* to define the scope of Renton's baseline inventory. Defining the scope of the inventory involved setting boundaries in the following areas:

Emission sources scope: which emissions sources to include.

Time scope: which time frame or year to include.

Geographic scope: what geographic boundaries to include.

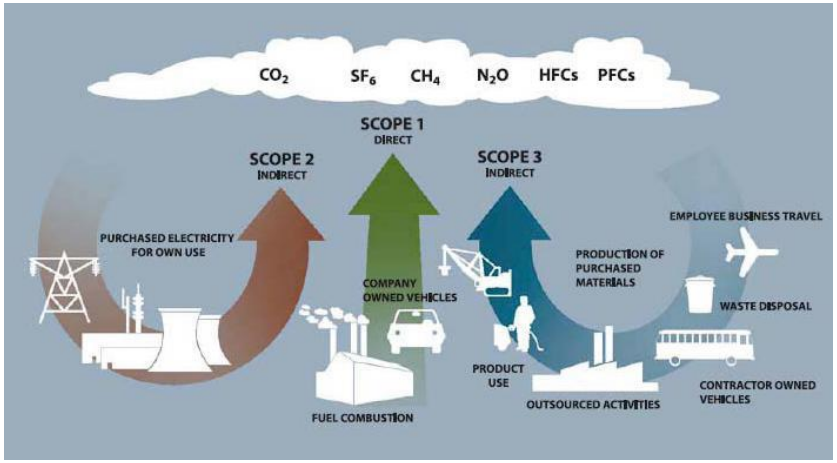
Emission Sources Scope

The *Greenhouse Gas Protocol* delineates *scopes* that define the boundaries within which greenhouse gas accounting should be conducted, as shown in **Figure 1**.[1] The scopes describe the relative level of control or responsibility the entity (in this case, Renton) maintains for each of its emission sources.

Scope 1 emissions are those that the city has most direct control over, while Scope 2 and 3 emissions are more indirectly attributed to the city. Specifically, Scope 1 emissions include all direct sources of greenhouse gas emissions that originate from equipment and facilities owned or operated by the city.

[1] *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard* (Revised Version), World Resources Institute and World Business Council for Sustainable Development, Figure 3. "Overview of scopes and emissions across a value chain." Available online at http://www.ghgprotocol.org/files/ghg-protocol-revised.pdf

Figure 1. Scope classification for the inventory of greenhouse gas emissions



Scope 2 emissions include those from electricity, heat, or steam imported from other entities—that is, energy used by the city but generated by others, such as a utility elsewhere.

Scope 3 emissions include all other indirect sources of greenhouse gas emissions that may result from the activities of the city, but that occur from sources owned or controlled by another company or entity. Scope 3 includes such as emissions from leased spaces, business travel, and employee commuting (when not conducted in the city's own fleet); embodied emissions in material goods purchased by the city; emissions from solid waste disposal; and emissions from vendor services such as shipping or catering.

The World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), authors of the *Protocol*, suggest conducting accounting for Scope 1 (direct emissions from owned equipment and operations) and Scope 2 (indirect emissions from purchased energy use) *at a minimum*. This inventory accounts for Scope 1, Scope 2, and Scope 3 sources.

Time Scope

In conducting a greenhouse gas inventory, establishment of a base year allows for a meaningful and consistent comparison of emissions over time. In choosing a base year, we considered which year offered a complete and accurate data set and will be representative of the general level of annual emissions. Due to the abundant data availability, we established the inventory base year as the 2009 calendar year. This inventory assesses greenhouse gas emissions for this base year.

Geographic Scope

We calculated emissions based on the activities of businesses, organizations, and people that resided within the formal city boundaries for Renton during the base year (2009). Future inventories should account for any changes in city boundaries between the base year and future inventory years.

Municipal Inventory Scope

We used the *Local Government Operations Protocol* (LGOP) to conduct the municipal inventory. [2] Although this protocol generally adheres to the principles and methods outlined in The *Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard*, the LGOP is specifically tailored for use by local governments and takes an "operational control approach" that targets emissions that local municipalities can most easily and directly influence. Using this protocol better enables Renton to compare its greenhouse gas inventory with other municipalities that have drawn similar boundaries by following the LGOP, although no two inventories are exactly alike.[3]

[2] Local Government Operations Protocol: For the Quantification and Reporting of Greenhouse Gas Emissions Inventories, Version 1.1, September 2008, p. 14. California Air Resources Board, California Climate Action Registry, ICLEI—Local Governments for Sustainability, The Climate Registry. Available online at http://www.icleiusa.org/actioncenter/tools/lgo-protocol-1.

[3] In particular, emissions inventories may look very different depending on what community service operations a city provides. These operations include water conveyance, wastewater treatment, public transit operation, solid waste collection, and landfilling. Of these services, Renton is only responsible for water conveyance.

Figure 2 (right) shows the emissions sectors, sources, and scopes included in the municipal inventory. The *sectors* we considered include building energy use, fleet fuel consumption, electricity used by water and wastewater pump stations, solid waste, refrigerants, traffic and street lights, business travel, and employee commuting. Emissions *sources* include electricity consumption, natural gas, gasoline, and diesel.

Community Inventory Scope

We based the community inventory on ICLEI standards and common methods used by other ICLEI members. The community emissions are from a variety of sources and are not categorized into Scope 1, 2, and 3. The community emissions are organized into five primary categories: 1) Residential, 2) Commercial, 3) Industrial, 4) Transportation, and 5) Solid Waste, as shown in **Figure 3** (right).

Figure 2. Scope of inventory for municipal emissions. Facilities and activities over which the City of Renton has operational control are included as Scope 1 or 2 emissions. Other emissions are included as "optional" Scope 3 emissions.

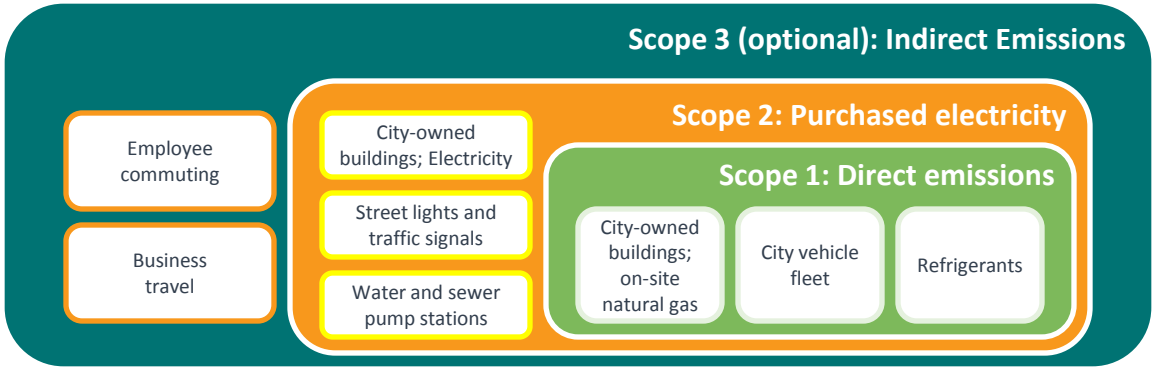
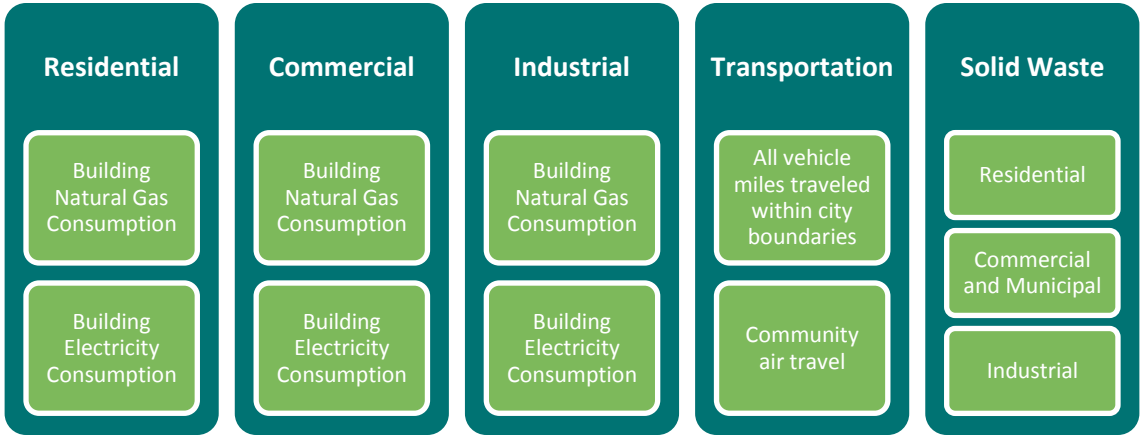


Figure 3. Scope of inventory for community emissions



2. COLLECT THE DATA

Collecting data is often the most time-intensive step of conducting a greenhouse gas inventory. To streamline the process and ensure accurate data collection, Cascadia trained all relevant Renton staff on the greenhouse gas inventory process. The trained staff then collaborated with Cascadia to obtain data from a variety of local and regional sources, as shown in **Table 1**. Specifically, City staff contributors included Tracy Schuld (Finance Department); David Hohn and Linda Knight (Public Works Department); Greg Stroh, Peter Renner, and Kelly Beymer (Community Services Department). Kris Sorensen in the Community and Economic Development Department also helped coordinate the data collection process.

Due to time and data availability limitations, we also made some assumptions and special considerations in conducting this inventory, listed in **Table 1**.

Table 1. Data sources and considerations for municipal and community greenhouse gas inventories

Data	Data Item	Source	Assumptions and Special Considerations
COMMUNITY			
Energy Use	Natural gas Electricity	David Namura, Puget Sound Energy	Emission factor used: Regional eGRID
Transportation	Vehicle miles traveled Airline travel	Kris Overby, Puget Sound Regional Council Port of Seattle, 2006 Sea-Tac Passenger Enplaning Survey	Estimated fuel type for each vehicle category (e.g., diesel or gasoline heavy truck) from regional data.
Waste	Recycling, organic, and solid waste breakdown Solid waste composition	Linda Knight, Solid Waste Coordinator King County Waste Composition Study, 2007	Assumed waste composition is similar to that of King County.
MUNICIPAL			
Employee Commuting	Employee commuting modes Breakdown of SOV vehicle types	2009 CTR Survey Auburn GHG Inventory, 2010	Assumed vehicle composition for commuters that drive alone is similar to that of the community. Assumed SOV types similar to City of Auburn.
Business Travel	Business travel modes and miles	Tracy Schuld, Accounting Supervisor	
Vehicle Fleet	Total fuel usage Golf course equipment	David Hohn, Fleet Manager Kelly Beymer, Parks and Golf Course Director	
Energy Use	PSE account data Facilities energy efficiency	Nathan Namura, Puget Sound Energy Peter Renner, Facilities Director	
Refrigerants	Fleet refrigerants Facilities refrigerants	David Hohn, Fleet Manager Greg Stroh, Facilities Manager	

3. CALCULATE EMISSIONS

In consultation with Cascadia, the City of Renton chose to use the widely accepted ICLEI Clean Air and Climate Protection (CACP) software for the Renton inventory. In 2001, ICLEI developed the CACP tool in partnership with the National Association of Clean Air Agencies (NACAA) and the U.S. Environmental Protection Agency. The original CACP has been updated to more closely follow the methods, standards, and data requirements specified by the LGOP. The CACP software, which is used by over a dozen municipalities in Washington and many more throughout the U.S., offered the most standard and comparable methodology for the City of Renton. As an ICELI member, Renton will have continued technical assistance and access to CACP updates for future inventories.

The CACP tool requires specific forms of inventory data. Although these data provisions can help ensure a thorough and accurate inventory, the demands of the CACP tool can also complicate the data collection process. For example, the CACP tool requires community transportation data to be, at a minimum, classified by vehicle type. We obtained data for Renton's total vehicle miles traveled (VMT) but did not have the vehicle type information for those VMT. Accordingly, we assumed that Renton has a similar vehicle composition to Auburn, a nearby city for which vehicle type information was established in 2010. **Tables 1** (previous page) and **2** (below) show other data requirements and assumptions for this inventory.

Table 2. Required data for input into ICLEI Clean Air & Climate Protection (CACP) tool

Data	Classification	Required forms
COMMUNITY		
Energy Use	Natural gas Electricity	kWh, Btu, or therms Separated by residential, commercial, and industrial
Transportation	Fuel use, by type	Vehicle/passenger miles, Btu, or gallons by vehicle class
Waste	Organic waste composition (paper, food, wood, etc.) Total waste; Waste disposal technology	Organic waste: percentage (%) composition Total waste in tons
MUNICIPAL		
Employee Commuting	Total fuel use, by type	Vehicle/passenger miles, Btu, or gallons by vehicle class
Business Travel	Total fuel use, by type	Vehicle/passenger miles, Btu, or gallons by vehicle class
Vehicle Fleet	Total fuel use, by type	Vehicle/passenger miles, Btu, or gallons by vehicle class
Energy Use	Buildings and facilities; Streetlights and traffic signals; Port facilities; Airport facilities; Water delivery facilities; Solid waste facilities	Electricity, fuel use, and/or natural gas; kWh, Btu, gallons, or therms
Mobile Source Refrigerants	Refrigerant use, by type	Weight (tons, pounds, etc.)
Electric Power (if applicable)	Fuel type (electricity, natural gas, etc.)	kWh, Btu, or therms

Methodology

To supplement the emissions data, we also collected information on the square footage of City-owned buildings. This information allows calculation of *emissions per square foot*, a comparable metric the City can use to target needed efficiency upgrades in City-owned buildings.

Once we entered all data into the CACP tool, municipal and community greenhouse gas emissions were calculated. We reported emissions in metric tons of carbon dioxide equivalent ($mtCO_2e$), the standard unit used in LGOP and other greenhouse gas reporting standards.

Key Findings

*The following sections present the key findings from Renton's **municipal** and **community** greenhouse gas inventories, including the sources and sectors contributing to Renton's emissions. The findings are intended to assist the City in planning future climate actions and tracking progress in reducing greenhouse gas emissions.*

MUNICIPAL EMISSIONS

Conducting a municipal emissions inventory can help Renton identify inefficiencies in municipal operations, prioritize opportunities for cost and energy savings, and gauge the City's progress toward leading its community in sustainability and environmental stewardship. Renton's municipal inventory is a measure of all greenhouse gas emissions produced by the City of Renton's municipal facilities and operations in a given year. In 2009, the City's operations generated an estimated 14,081 mtCO_2e, as shown in **Figure 4**.[4]

Building operations, which includes both natural gas and electricity use, is the largest emissions sector for municipal operations, accounting for 40% of total calculated emissions. Water delivery services (23%) and vehicle fleet (18%) contribute the next highest emissions.[5] Although Renton's municipal emissions are small compared to its community emissions, understanding its municipal emissions enables the City to take steps to lower greenhouse gas emissions in areas where it has more direct control and to lead by example.

[4] Although emissions tonnages are presented in tables and graphs as exact figures, all reported emissions in this report are estimates.

[5] The use of pie charts to represent emissions is not intended to indicate that 100% of emissions are accounted for. This is an estimate of emissions, and while Scope 1 and 2 emissions are as complete as possible, only a few key Scope 3 emissions sources are included in this inventory. Each pie chart in this document is meant to represent only the emissions measured in this inventory based on the boundaries recommended by the LGOP.

Figure 4. Municipal emissions for Renton by sector (14,081 metric tons CO_2e total)

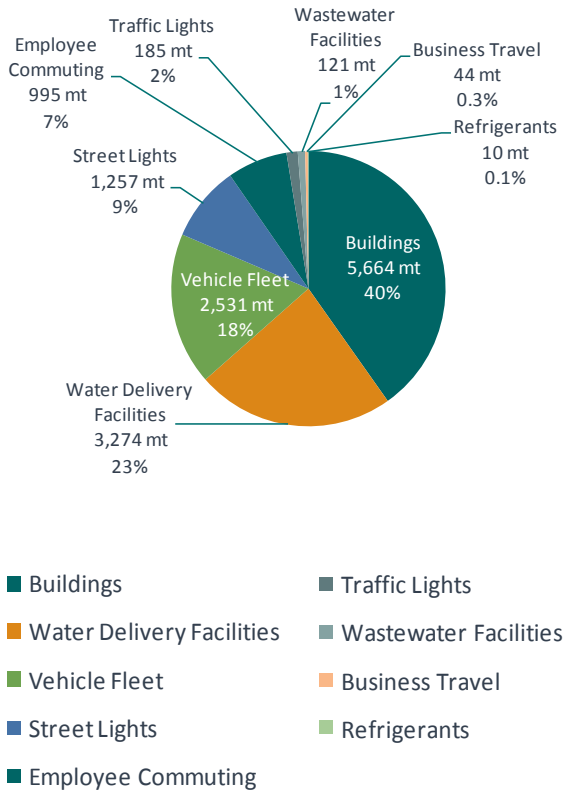


Figure 5 and **Table 3** show emissions by scope and sector for Renton's 2009 municipal emissions. Electricity use for City-owned and operated facilities (Scope 2 emissions) is the largest source of emissions at an estimated 9,318 $mtCO_2e$, or 66% of total emissions. These are emissions that Renton "purchased" from utilities and so can be influenced through efficiency measures and working with energy providers. Scope 1 emissions, which include emissions from Renton's vehicle fleet, refrigerant losses, and natural gas usage at City-owned and operated buildings, account for roughly 3,724 $mtCO_2e$, or 27% of all emissions. The City can most directly influence these emissions, such as through purchasing more efficient products, reduced use of materials, and other efficient practices. Scope 3 emissions—which include emissions from employee commuting, business travel, leased spaces, and solid waste—account for an estimated 1,039 $mtCO_2e$, or 7% of total emissions. Renton can influence these emissions through encouraging others to improve their practices.

Figure 5. Municipal emissions for Renton by scope for 2009 (14,081 metric tons CO_2e)

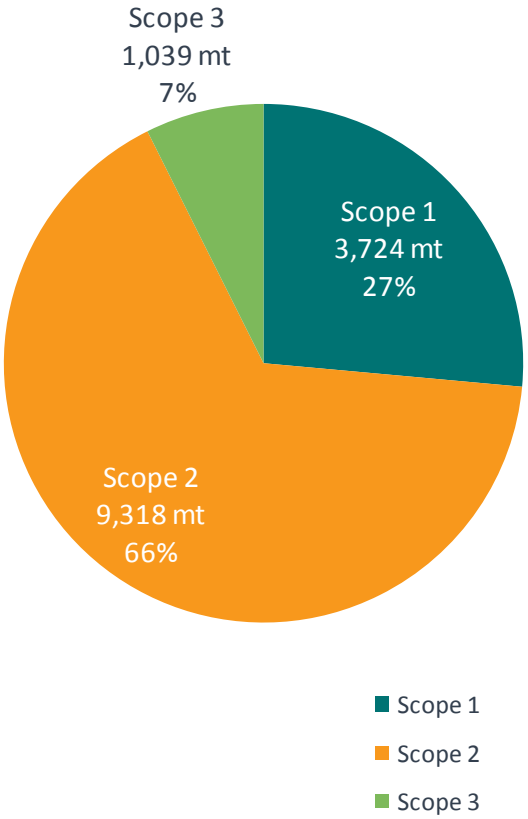


Table 3. 2009 Municipal emissions by scope and sector

Scope/Sector	$mtCO_2e$
Scope 1	**3,724**
Buildings	1,183
Refrigerants	10
Vehicle fleet	2,531
Scope 2	**9,318**
Buildings	4,481
Street lights	1,257
Traffic lights	185
Wastewater facilities	121
Water delivery facilities	3,274
Scope 3	**1,039**
Business travel	44
Employee commuting	995
Grand Total	**14,081**

Sector Analysis

Assessing municipal emissions by *sector* allows the City to take a more targeted approach to developing emission reduction strategies within its departments. This approach can also reveal unknown energy inefficiencies and cost savings opportunities within municipal operations.

Buildings

City buildings contributed about 40% of Renton's municipal footprint. **Table 4** shows the electricity use per square foot of the 10 buildings with the highest emissions per unit area. (We were unable to analyze total building energy use, including Scope 1 emissions from fuels combusted on-site for heating and hot water, because many natural gas accounts were combined such that energy use could not be allocated to individual buildings.) The five least efficient buildings in terms of electricity use per square foot are: 1) Henry Moses Aquatic Center, 2) Cedar Trail Park Restroom, 3) Philip Arnold Park Restroom, 4) Liberty Park Community Building, and 5) Old City Hall/200 Mill Building. Note that the three restrooms are each smaller than 500 square feet; though their electricity use per square foot is high, their overall impact remains relatively low. The Old City Hall Building has recently been renovated with energy-efficient upgrades, so its energy use is expected to be reduced from the estimate in this inventory.

Table 4. Renton municipal building electricity use per square foot (2009)

Building	Electricity use (annual KWh)	Square footage	Electricity Use (KWh) per sq ft
Henry Moses Aquatic Center	459,840	6,320	73
Cedar Trail Park Restroom	21,840	450	49
Phillip Arnold Park Restroom	11,560	290	40
Liberty Park Community Building	119,320	3,500	34
Old City Hall/200 Mill Building*	1,234,340	51,000	24
Jones Park Restroom	10,600	480	22
Highlands Library	135,810	6,580	21
Philip Arnold Park Activity Building	27,960	1,370	20
City Shops A-B-C-D & F	1,011,600	52,400	19
Fire Station # 12	289,960	15,800	18

** The Old City Hall/200 Mill Building was recently renovated, so its efficiency is expected to be improved since 2009.*

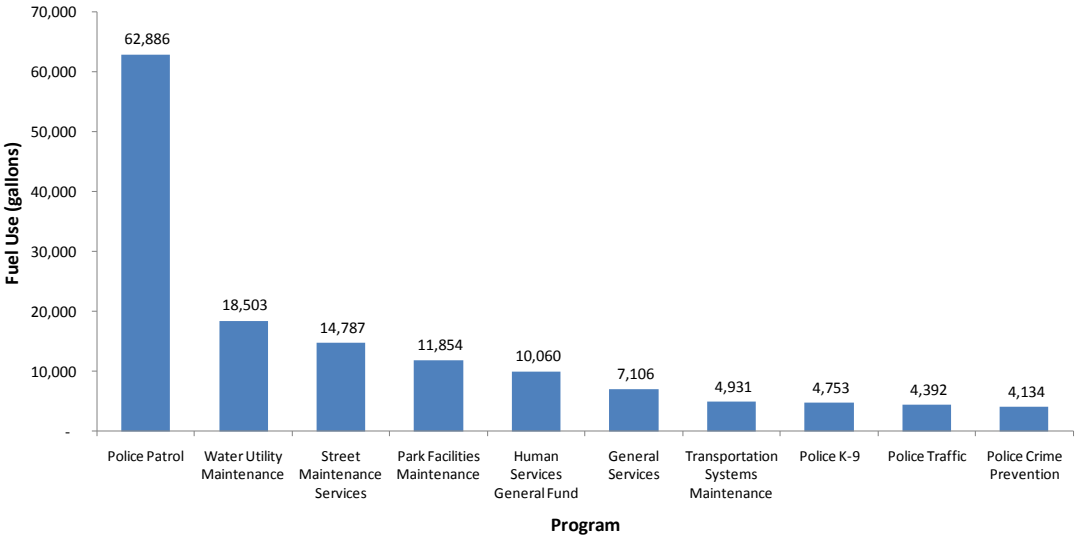
Vehicle Fleet

Renton's fleet contributed approximately 2,500 $mtCO_2e$ to the City's overall municipal footprint, representing roughly 18% of the 2009 municipal emissions. **Figure 6** shows the 10 City programs with the highest fuel use in 2009, which collectively represent 78% of the total 2009 City vehicle fuel use. Police patrol used the most fuel in 2009 by a wide margin: 62,886 gallons, more than one-third (34%) of the total 2009 vehicle fleet fuel use.

Fuel efficiency is a useful indicator of greenhouse gas impacts and can help Renton assess its impacts and identify opportunities to improve the efficiency of its fleet.[7] The average 2009 fuel economy for all of Renton's fleet was 14 mpg, less than half of the 2015 target fuel economy for Washington State agency vehicles.[8] Improving its fleet fuel economy will also help prepare Renton for any future state mandates for municipal fleet efficiency.

One program, Neighborhood Communities (within the Department of Community and Economic Development), stands out among Renton's fleet vehicles with a fuel efficiency average of 46 miles per gallon (mpg). This outstanding efficiency can be attributed to its single vehicle: a 2008 Ford Escape Hybrid.

Figure 6. Fuel use (gallons) for 10 City programs with highest passenger vehicle fuel use in 2009 (excludes non-passenger vehicles and equipment[6])



[6] Passenger vehicles include pickup trucks (1-ton or smaller), sport utility vehicles, and sedans. Fire trucks, heavy dump trucks (over 1-ton), prisoner vans, and other large vehicles are not included in the ranking, though their emissions are included in the overall inventory.

[7] In 2008, the Washington State Legislature directed the Department of Ecology to establish a mandatory reporting system for emissions of greenhouse gases. Initially, the Department of Ecology proposal stipulated that owners of fleets emitting 2,500 or more metric tons of carbon dioxide equivalents annually from on-road vehicles must report emissions. During the 2009-2010 legislative session (House Bill 2545), the Department of Ecology attempted to amend its rule to align with new federal greenhouse gas reporting requirements, but the amendment did not pass. apps.leg.wa.gov/billinfo/summary.aspx?bill=2545&year=2009.

[8] Washington RCW 43.41.130 states "(3) State agencies shall phase in fuel economy standards for motor pools and leased petroleum-based fuel vehicles to achieve an average fuel economy standard of thirty-six miles per gallon for passenger vehicle fleets by 2015."

Table 5 (below) shows the 10 least efficient passenger vehicles in Renton's fleet.[9]

[9] Passenger vehicles include pickup trucks (1-ton or smaller), sport utility vehicles, and sedans. Fire trucks, heavy dump trucks (over 1-ton), prisoner vans, and other large vehicles are not included in the ranking, though their emissions are included in the overall inventory.

Table 5. Least fuel-efficient vehicles in Renton's fleet in 2009

Vehicle	Department	2009 Fuel Efficiency (mpg)
1994 GMCX S10	Renton Housing Authority	5.8
2006 FORD F250	Park Facilities Maintenance	6.6
2005 FORD EXPEDITION	Police Patrol	6.8
2008 FORD F350	Transportation Systems Maintenance	6.9
2000 FORD F450	Street Maintenance Services	6.9
1997 FORD F350	Park Facilities Maintenance	7.0
1994 DODGE VAN	Renton Housing Authority	7.0
2002 CHEV G30	Police Investigation	7.0
2000 FORD 250	Transportation Systems Maintenance	7.0
2000 CHEV S10	Renton Housing Authority	7.1
2000 FORD F550	Park Facilities Maintenance	7.1
2008 FORD EXPEDITION	Police Patrol	7.1
1994 GMCX S10	Animal Control	7.1

Figures 7 and 8 show the average fuel efficiency for fleet vehicles used in 2009 by department (**Figure 7** (below)), and by vehicle (**Figure 8** (next page)) as compared to the 2015 Washington State fuel economy standards.

Figure 7. Average fuel efficiency for Renton fleet vehicles used in 2009, by department, as compared to the Washington State fuel economy standards by 2015. Each data point represents the average fuel efficiency for a City of Renton department.

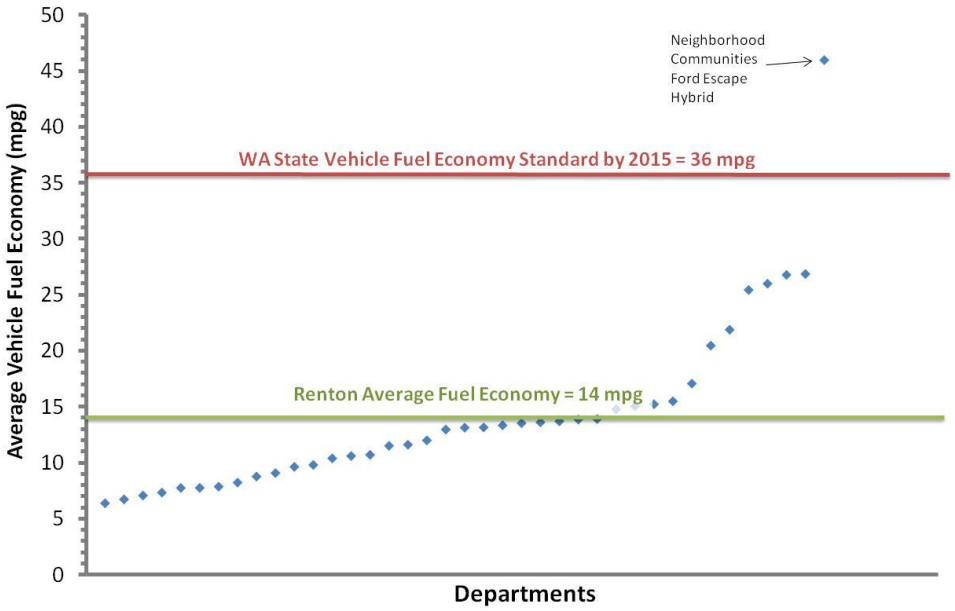
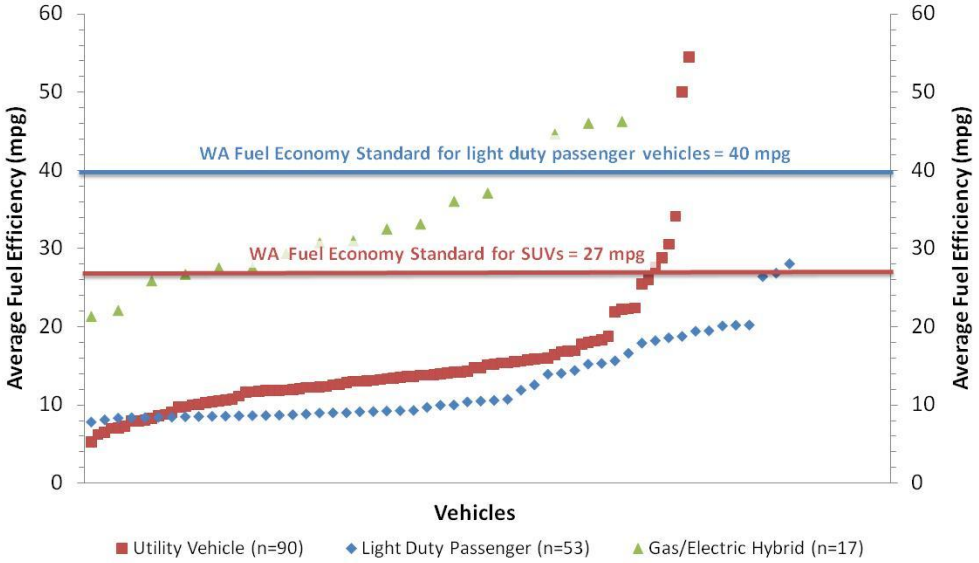


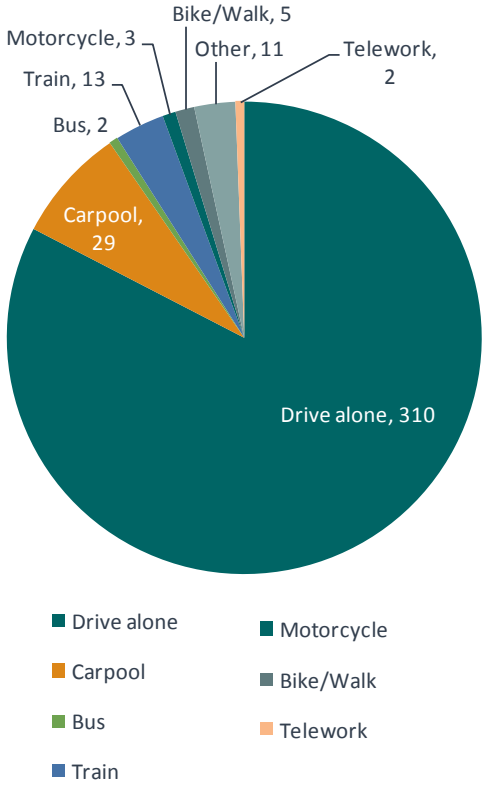
Figure 8. Fuel efficiency for Renton passenger fleet vehicles used in 2009, as compared to the Washington State fuel economy standards by 2015. Each data point represents the fuel efficiency of one fleet vehicle.



Employee Commuting

Employee commuting makes up roughly 7% of Renton's municipal inventory. Renton employees use various forms of transportation for commuting, including driving, carpooling, riding the bus, taking the train, and walking. **Figure 9** (right) shows the employee mode split. (Each mode is represented by the number of employees that participated in that mode *each day*, for the longest distance, to commute to their usual work location.)

Figure 9. Renton employee commuting habits by staff member participation in various modes (primary mode for each week). Source: 2009 CTR Survey Report; Q4a.

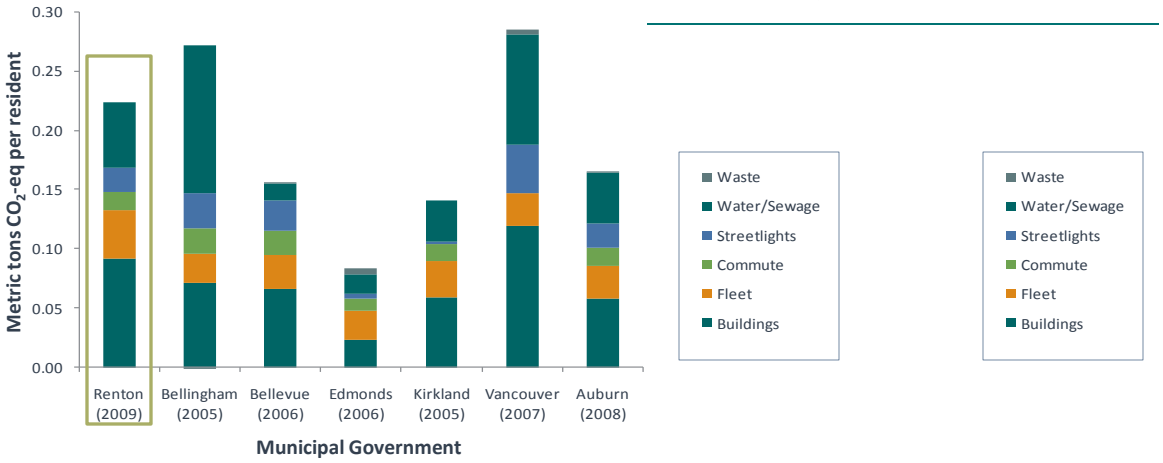


Municipal Emissions in Context

Examining Renton's community emissions in relation to other municipalities and jurisdictions emissions may provide important context for Renton. These comparisons should only be used as a rough indicator of Renton's progress, however, as no two inventories are exactly comparable. For example, Renton did not include municipal solid waste in its emissions calculations, whereas Auburn included municipal solid waste. **Figures 10** and **11** show Renton's municipal emissions as compared to nearby municipalities.

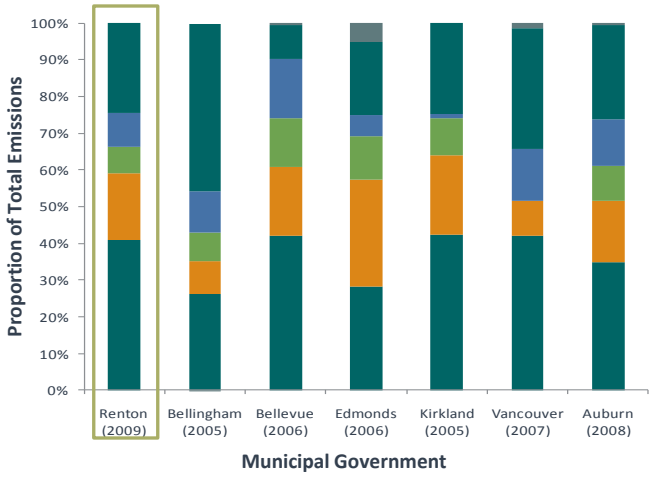
On a per-capita basis, Renton's overall municipal emissions (0.22 $mtCO_2e$ per resident) in 2009 were comparable to those recorded in other nearby municipalities' inventories, as shown in Figure 12.[10] Specifically, Renton's commuting and streetlight emissions are comparable to those of other municipalities, while the emissions from buildings, vehicle fleet, and water delivery are somewhat higher. These results suggest that the most significant opportunities for emissions reductions within Renton's municipal operations may be found in buildings, vehicle fleet, and water delivery services.

Figure 10. Municipal emissions for Western Washington jurisdictions on a per-capita basis



[10] Because the compared municipalities did not include business travel, this figure (0.22 mtCO2e per resident) does not include business travel. With business travel included, Renton's 2009 per-capita municipal emissions were 0.23 mtCO2e per resident.

Figure 11. Proportional composition of municipal emissions for selected jurisdictions in Western Washington



COMMUNITY EMISSIONS

Renton's community inventory is a measure of the greenhouse gas emissions resulting from activities within the city limits. In 2009, the Renton community generated an estimated 1,216,258 metric tons of carbon dioxide equivalents ($mtCO_2e$). **Figure 12** shows the breakdown of community emissions by *sector*.[11] Transportation contributed the largest share—nearly half—of emissions (49%), followed by commercial (21%) and residential energy use (20%). Solid waste accounted for a small portion (0.3%) of total community emissions.

Renton's substantial community transportation emissions are on par with estimations in other regional and statewide inventories. The State of Washington estimates that transportation makes up 47% of emissions statewide.[12]

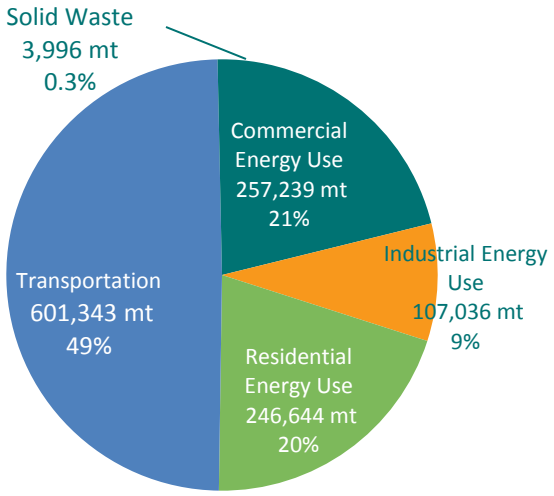
Solid waste, as calculated by the ICLEI CACP software, accounts for less than 1% of the total community inventory. As discussed below, a closer examination of the CACP methodology for calculating solid waste greenhouse gas emissions could help the City of Renton best interpret this figure.

The solid waste section of the CACP tool has several inputs. First, a user specifies the total waste production in tons. In this inventory, the community of Renton generated roughly 42,739 tons of solid waste during 2009. Second, the user determines which "waste disposal technology" is used for solid waste management. Options included Uncollected, Open Dump, Open Burning, Managed Landfill, Controlled Incineration, and Compost. Renton's municipal solid waste goes to King County's Cedar Hills Landfill, a managed landfill.

[11] Although emissions tonnages are presented in tables and graphs as exact figures, all reported emissions in this report are estimates.

[12] Washington State Department of Community, Trade, and Economic Development, *Washington State Greenhouse Gas Inventory and Reference Case Projections, 1990-2020* (December 2007), http://www.ecy.wa.gov/climatechange/docs/WA_GHGInventoryReferenceCaseProjections_1990-2020.pdf

Figure 12. Renton 2009 community emissions by sector (1,216,258 metric tons CO_2e total)



Then, the user specifies the waste composition mix by percentage of the following: Paper Products, Food Waste, Plant Debris, Wood or Textiles, and All Other Waste. Data for the City of Renton came from the King County Waste Monitoring Program, *2007 Waste Characterization Study*, published in 2008. Lastly, the CACP tool requires a methane recovery rate for the managed landfill. King County reports that Cedar Hills attains a 90% methane capture rate.[13]

A 2009 U.S. EPA report notes that material production and waste management are responsible for 42% of U.S. emissions.[14] The CACP tool's emissions from waste do not account for any upstream processing or embodied emissions of products or for the energy used for waste collection or processing. The emissions shown in this inventory are only from decomposition of waste in a landfill. A more thorough review of the emissions associated with materials consumed in the City of Renton was beyond the scope of this inventory.

Table 6. Key Metrics for 2009 community inventory

Sector	2009 Inventory Metric ($mtCO_2e$)
Residential emissions per household	9.4
Residential emissions per resident	4.0
Commercial and industrial emissions per employee	7.5
Waste emissions per resident	0.1
Overall community emissions per resident	19.6

Key Metrics and Comparisons

The development of key metrics allows for a standardized comparison across years. **Table 6** (above) provides key metrics for Renton's overall community emissions in relevant categories.

In addition to key metrics, comparing Renton's community emissions to other jurisdictions can help Renton understand its current position and identify opportunities for reductions. These comparisons should only be used as a rough indicator of Renton's progress, however, as no two inventories are exactly alike. For example, Renton included community air travel (contributing 53,688 $mtCO_2e$) in its transportation emissions calculations, while Auburn included only vehicle miles traveled. Nonetheless, even a rough comparison can help the City better understand its progress within a regional context.

[13] Personal Communication Mizanur Rahman, Ph.D., MBA, P.Eng., Engineer III and Project Manager, Engineering Services Section, Solid Waste Division, King County Dept. of Natural Resources and Parks. August 4, 2009.

[14] "Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices," U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, September 2009. Available online at www.epa.gov/oswer/docs/ghg_land_and_materials_management.pdf.

Figure 13(below) and **Table 7** (right) show Renton's per-capita community emissions as compared to nearby municipalities.

Figure 13. 2009 Per-capita community emissions for Renton as compared to nearby municipalities

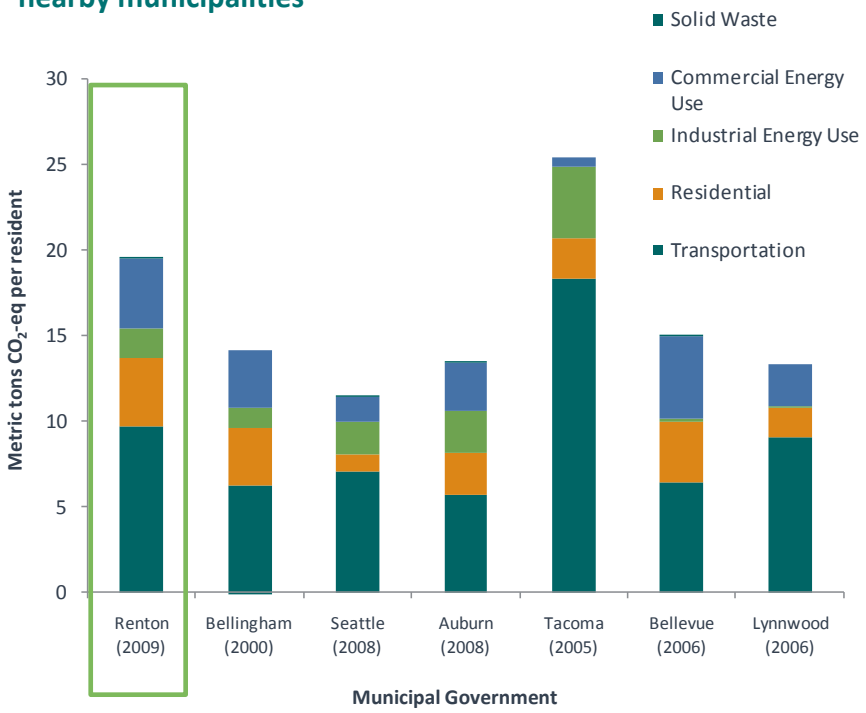


Table 7. Local municipalities' per-capita community greenhouse gas emissions

Municipality	Inventory Year	Community Inventory ($mtCO_2e$)	Population in Inventory Year [15]	Emissions per capita
Renton	2009	1,216,258	62,002	19.6
Bellingham[16]	2000	950,792	67,171	14.1
Seattle[17]	2008	6,830,000	602,934	11.5
Auburn[18]	2008	843,328	62,819	13.4
Tacoma[19]	2005	4,935,054	193,911	25.5
Bellevue[20]	2006	1,775,480	118,161	15.0
Lynnwood[21]	2006	445,157	33,369	13.3

[15] U.S. Census Bureau American FactFinder. Available online at http://factfinder.census.gov. Accessed January 2011.

[16] Greenhosue Gas Emissions Inventory for Bellingham. Available online at www.cob.org/services/environment/climate/greenhouse-gas-inv.aspx. Accessed January 2011.

[17] Seattle's Community Carbon Footprint: An Update. Available online at www.thestranger.com/images/blogimages/2010/10/25/1288028341-2008-community-inventory-fullreport.pdf. January 2011.

[18] Greenhouse Gas Inventory for the City of Auburn, WA. April 2010.

[19] Tacoma Emissions Inventory. Mayor's Green Ribbon Task Force. April 16, 2007.

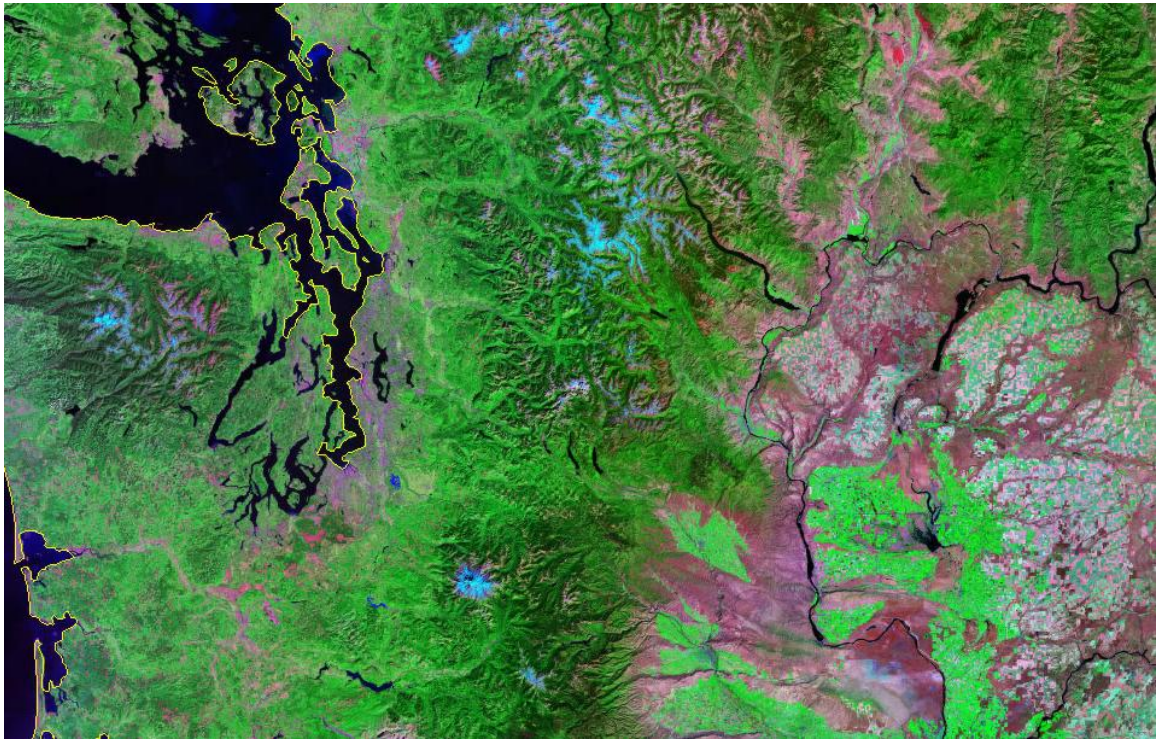
[20] City of Bellevue Greenhouse Gas Emissions Inventory. Updated June 2008.

[21] City of Lynnwood Greenhouse Gas Emissions Inventory and Reference Forecast. Version 0.95. July 30, 2009. Available online at http://ci.lynnwood.wa.us/ECouncilDocs/Items/8077/Report%20vers%200.95.pdf. Accessed March 2011.

Relative to the compared municipalities, Renton's per-capita community transportation emissions contribute a large share of the city's overall emissions.

Transportation in the community inventory typically includes all emissions from vehicle miles traveled on roads within city boundaries. These emissions are not limited to vehicle miles traveled by Renton residents, although residents are certainly responsible for a portion of the total. Renton is a major transportation hub for the region, as many vehicles travel through Renton on Interstate 405 on their way to other areas of the Puget Sound. The contribution of these I-405 vehicles to Renton's emissions may account for a portion of Renton's substantial transportation emissions.

Furthermore, community transportation emissions for municipalities typically only consider vehicle travel. Renton's decision to include air travel in addition to vehicle travel contributed an additional 53,688 $mtCO_2e$ (9%) to Renton's estimated transportation emissions, thus further increasing its calculated per-capita carbon footprint. (Other jurisdictions likely still generate emissions from air travel, even though these emissions were omitted from calculation in their greenhouse gas inventories.)



Next Steps

With its first greenhouse gas inventory completed, Renton is now positioned to take its next steps toward a greener and cleaner future. This section describes how results from this inventory may inform these next steps for the City of Renton.

TAKING ACTION TO REDUCE EMISSIONS

Renton's municipal and community greenhouse gas inventories offer solid foundations for taking action. In addition to direct actions Renton can take to reduce emissions within its own municipal operations, the City can take transformative actions to encourage the Renton community to reduce energy consumption and emissions.

Municipal Inventory

As a relatively small contributor to Renton's total emissions, the City itself cannot greatly reduce Renton's overall emissions through municipal actions alone. Municipal action has strong symbolic value, however, and demonstrates leadership that extends far beyond the magnitude of emissions actually reduced.

The highest source of emissions within Renton's municipal operations is from the energy used to power and heat the City's buildings, accounting for 40% of municipal emissions. Actions Renton could take to reduce building emissions include conducting energy audits on all City buildings, implementing energy efficiency management and performance monitoring systems, targeting efficiency upgrades on energy-intensive buildings, and installing motion sensor-controlled lighting in all municipal building spaces.

Electricity used to pump water and wastewater represents 23% of Renton's municipal emissions, the second highest emitting sector. The City can work toward reducing these emissions by decreasing the amount of water that needs to be treated (such as through low impact development techniques); by minimizing water demand through conservation measures; and by increasing the efficiency of equipment to treat, store, and transport water.

Renton's third highest emitting sector was its vehicle fleet, contributing 18% of Renton's total municipal emissions. Renton can reduce fleet emissions by purchasing the most fuel-efficient City vehicles and creating policies for employees to limit idling and use the most fuel-efficient vehicles whenever possible.

Community Inventory

The main sources of emissions in the community of Renton as a whole are transportation (49%) and energy use from commercial (21%), residential (20%), and industrial (9%) sources. Transportation is the single largest emissions source, but building energy use is the largest contributor (50%) when taken as a whole, instead of divided into residential, commercial, and industrial categories.

While the City can encourage Renton residents and businesses to reduce energy consumption and reduce vehicle miles, the City does not have direct control over most of the emissions in the community inventory.

Despite these limitations, initiatives to encourage energy conservation include educational campaigns to publicize utility rebates and changing city code to support energy efficiency in new and existing buildings. Commute trip reduction campaigns, improving and increasing bike lanes, increasing the number of park-and-ride spaces, and improving access to public transportation are examples of ways to help reduce vehicle miles traveled.

Setting Targets

Although outside the scope of this inventory, establishing emission reduction targets and monitoring progress provides a clear way for the city to solidify commitments, promote action, and ensure results. Given Renton's different levels of control over its community and municipal inventories, Renton should consider setting separate emissions reduction targets for its municipal and community operations. Regional and local examples of other jurisdictions' emission reduction targets can help inform Renton's targets and goals. **Table 8** (on the following page) shows emissions reduction goals for other jurisdictions.

Renton is a signatory to the U.S. Conference of Mayors' Climate Protection Agreement, which commits Renton to strive to meet the Kyoto Protocol targets (7% below 1990 levels by 2012) and to urge Washington State government and the federal government to enact emission reduction policies and programs. Given the short time frame for meeting the 2012 target, many other signatories of the Climate Protection Agreement have followed up on their commitment with longer-term goals, often linked to more recent base years (post-1990). In addition, many of these cities specify separate goals for community and municipal operations, which the Climate Protection Agreement does not distinguish.

Thus, in setting emissions reduction targets, Renton can look to many examples that use the U.S. Mayors' Climate Protection Agreement as a starting point but set longer-term emission reduction targets (beyond 2012). Like other cities, Renton can develop separate targets for municipal and community emissions reductions. Because actual data exist in the baseline inventory, 2009 appears a logical base year from which City can set emissions reduction targets.

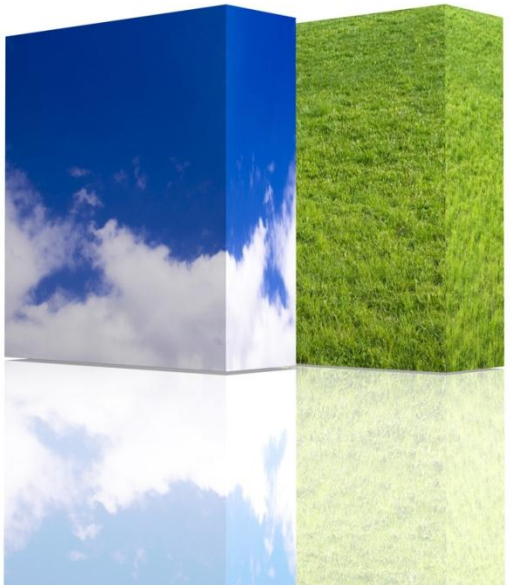


Table 8. Relevant frameworks and targets for greenhouse gas emission reduction

Entity/Agreement	Emissions Reduction Goal	Notes/Source
Intergovernmental Panel on Climate Change	Recommends a 50-85% permanent reduction below 1990 levels by 2050 to stabilize carbon dioxide levels at 450 ppm	IPCC 4th Assessment Report, Working Group III
Kyoto Protocol	7% below 1990 levels by 2012	United Nations Framework Convention on Climate Change, Kyoto Protocol, 1997
U.S. Conference of Mayors' Climate Protection Agreement	7% below 1990 levels by 2012 (consistent with Kyoto Protocol)	More than 1,000 U.S. mayors have signed on (including Renton's past mayor Kathy Keolker-Wheeler)
State of Washington	Reduce to 1990 levels by 2020, 25% below 1990 levels by 2035, 50% below 1990 levels by 2050	SSB 6001 (May 2007)
King County	80% below 2007 levels by 2050	Part of the Cool Counties Initiative
Anacortes	15% below 2000 levels by 2020	City of Anacortes Greenhouse Gas Inventory and Proposed Climate Action Plan (November 2006)
Bellingham	Municipal: 70% below 2000 levels by 2020 Community: 28% below 2000 levels by 2020	Sustainability Achievements and Measures in Place, City of Bellingham (2009-2010)[22]
Bellevue	7% below 1990 levels by 2012	City of Bellevue, Washington Greenhouse Gas Inventory (October 2007, updated June 2008) [23]
Kirkland	20% below 2005 levels by 2020	City of Kirkland Climate Protection Action Plan (April 2009) [24]
Lynnwood	7% below 1990 levels by 2012	City of Lynnwood Greenhouse Gas Emissions Inventory and Reference Forecast, Version 0.95 (July 2009) [25]
Seattle	7% below 1990 levels by 2012	Seattle Climate Protection Initiative Progress Report (2009)
Spokane	30% below 2005 levels by 2030	City of Spokane Greenhouse Gas Inventory (December 2008)
Tacoma	7% below 1990 levels by 2012	Tacoma Emissions Inventory, Mayor's Green Ribbon Task Force (April 2007)
Vancouver	7% below 1990 levels by 2012	City of Vancouver Policy Report (April 2010)

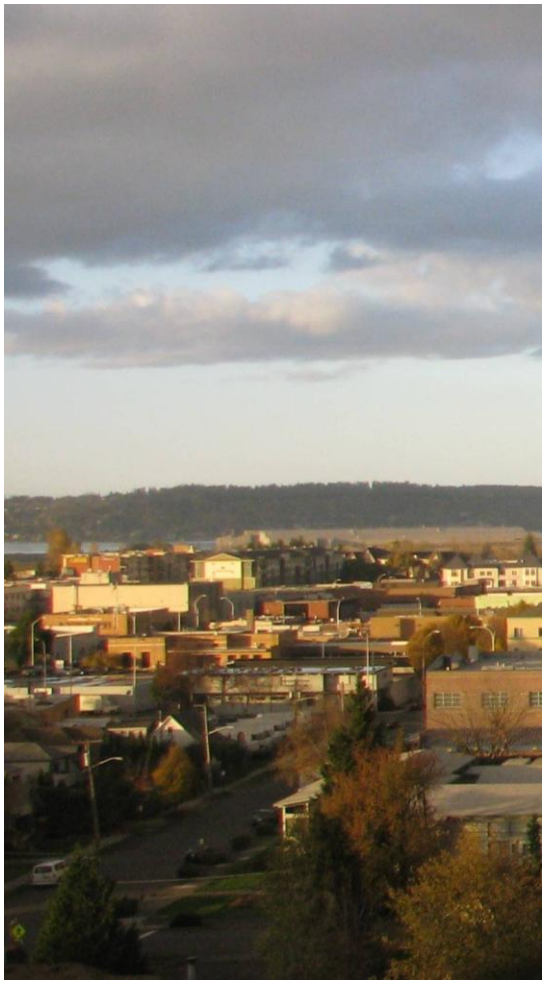
[22] Available at: http://www.cob.org/documents/pw/environment/sustainability-measures-2009-2010.pdf

[23] Available at: http://www.ci.bellevue.wa.us/pdf/Manager/Greenhouse_Gas_Emissions_Inventory.pdf

[24] Available at: http://www.ci.kirkland.wa.us/Assets/Kirkland+Green/Kirkland+Green+PDFs/Climate+Protection+Action+Plan.pdf

[25] Available at: http://ci.lynnwood.wa.us/ECouncilDocs/Items/8077/Report%20vers%200.95.pdf

[26] Available at: http://vancouver.ca/sustainability/climate_protection.htm



Setting a Community Emissions Target

The City does not have direct control over most of the emissions in the community inventory. Future population growth in the region will likely further increase Renton's community greenhouse gas emissions. This lack of control combined with these anticipated population trends may mean that feasible community emission reduction goals may need to be less aggressive than those for its municipal operations.

Setting a Municipal Emissions Target

Many opportunities for emissions reduction in Renton's municipal operations are likely to yield significant cost savings and other benefits. Accordingly, setting an aggressive reduction target makes sense for Renton's municipal emissions. The City should consider setting an emissions reduction goal close to Washington State's goals for its own agencies: 15% below 2005 emission levels by 2020, and 36% below 2005 levels by 2035, using the City's own baseline year of 2009.

Future Inventories

Having completed a baseline inventory, the City is well positioned to update its greenhouse gas inventories on an annual basis. **Table 9** on the following page identifies steps City staff can take to facilitate and improve the data collection process for future inventories.

Furthermore, incorporating energy costs into the inventory can facilitate identification of cost savings opportunities within an emissions reduction framework. Incorporation of energy costs was outside the scope of this inventory; however, Renton may benefit from incorporating cost data in future inventories.

Conducting a municipal and community-wide greenhouse gas inventory serves as an integral first step for Renton. Achieving substantial reductions in greenhouse gas emissions will involve future inventories, sustained effort over time, and a portfolio of aggressive actions and initiatives by Renton and its citizens.

Table 9. Issues for Renton to address to facilitate future inventories

Inventory Component	Sector	Issue	Recommendation	Contact
MUNICIPAL	Electricity and natural gas consumption	Data were only available in PDF form. All energy consumption data had to be manually digitized.	Work with PSE to obtain data in a more usable form.	David Namura, PSE
	Electricity and natural gas consumption	Some energy accounts were combined, restricting ability to target individual facilities.	Work to establish separate accounts for each facility.	David Namura, PSE Tracy Schuld, Renton Accounting Manager
	Electricity and natural gas consumption	Street and traffic lights were not distinguished between metered and flat-rate.		
	Fleet fuel consumption	Data were only available in PDF form. All vehicle type and use data had to be manually digitized.	Establish a methodology for retrieving this data in a more usable form.	David Hohn, Renton Fleets Manager
	Business Travel	Received data did not specify vehicle type.	Establish a methodology for tracking business travel by vehicle type.	Tracy Schuld, Renton Accounting Manager
	Municipal Waste	Was not measured in this inventory.	Gather municipal waste data for next inventory.	Linda Knight, Solid Waste Coordinator
COMMUNITY	Lighting Energy Consumption	Provided with a general "lighting" energy use value, contributed from both municipal and commercial operations.	Allocate these general lighting accounts to specific sectors (municipal, commercial, residential, or industrial).	David Namura, PSE


City of
Renton